XXIII. "Fourth and concluding Supplementary Paper on the Calculation of the Numerical Value of Euler's Constant." By WILLIAM SHANKS. Communicated by Professor STOKES, Sec. R.S. Received June 14, 1869.

When $n=10000$, we have

$1+\frac{1}{2}+\frac{1}{3}+\ldots\frac{1}{10000}=$

9·78760 60360 44382 26417 84779 04851 60533 48592 62945 57772 17183 89460 97673 221+

$\text{Log}\ \epsilon\ 10000+\frac{1}{20000}=$

9·21039 03719 76182 73607 19658 18737 45683 04044 05954 51509 19041 33305 21764 185+

Result of "Bernouilli's" =+

·00000 00008 33333 33250 00000 03968 25392 65873 02344 87732 37845 49617 88207 355, &c.

E=

·57721 56649 01532 86060 65120 90082 40243 10421 59335 93995 35988 05773 64116 391.

On comparing the value of E when n is taken 10000, with former values already given, we cannot but conclude that the limits assigned to the value of E in the Third Supplementary Paper have been confirmed, and that nothing more seems requisite as to the determining of the numerical value of this curious constant.

XXIV. "On the Refraction-Equivalents of the Elements." By J. H. GLADSTONE, Ph.D., F.R.S. Received June 17, 1869.

(Abstract.)

This paper is a continuation of the researches on refraction which have been already published by the author in conjunction with the Rev. T. Pelham Dale*.

It is divided into two parts—the data, and the deductions. The data consist of the refraction-equivalents of some simple and many compound bodies, calculated from the indices observed by various chemists and physicists, or by the author himself; together with a series of observations on about 150 salts in solution. The method of examining these, and the nature of the inference to be drawn from such experiments, have already been explained in the Proceedings of the Royal Society, 1868, pp. 440–444.

The deductions consist of a comparison of the evidence bearing on each elementary substance, beginning with carbon, hydrogen, and oxygen, which were in the first instance determined by Landolt. In the case of some elements all the means of calculation lead to the same number within probable errors of experiment; but in the case of others two or more

* Phil. Trans, 1863, p. 317.

different equivalents are indicated. Thus iron has one value in the ferrous and another in the ferric salts; and the more highly oxidized compounds of sulphur, phosphorus, arsenic, and nitrogen give different numbers from those given by their simpler combinations. The refraction-equivalent of potassium is estimated from a variety of sources, and the number thus arrived at is employed for the calculation of the other metals that give soluble salts, and for the radicals with which they are combined.

The following Table gives the general results of these deductions:—

Element.	Atomic weight.	Refraction-equivalent.	Specific refractive energy.
Aluminium	27·4	8·4	0·307
Antimony	122	24·5 ?	0·201 ?
Arsenic	75	15·4 (other values ?)	0·205
Barium	137	15·8	0·115
Boron..............	11	4·0	0·364
Bromine...........	80	15·3 In dissolved salts 16·9	0·191 or 0·211
Cadmium	112	13·6	0·121
Cæsium	133	13·7 ?	0·103 ?
Calcium	40	10·4	0·260
Carbon	12	5·0	0·417
Cerium	92	13·6 ?	0·148 ?
Chlorine...........	35·5	9·9 In dissolved salts 10·7	0·279 or 0·301
Chromium	52·2	15·9 In chromates 23 ?	0·305 or 0·441 ?
Cobalt	58·8	10·8	0·184
Copper	63·4	11·6	0·183
Didymium.........	96	12·8 ?	0·133 ?
Fluorine...........	19	1·4 ?	0·073 ?
Gold	197	24·0 ?	0·122 ?
Hydrogen	1	1·3 In hydracids 3·5	1·3 or 3·5
Iodine	127	24·5 In dissolved salts 27·2	0·193 or 0·214
Iron	56	12·0 In ferric salts 20·1	0·214 or 0·359
Lead	207	24·8	0·120
Lithium............	7	3·8	0·543
Magnesium	24	7·0	0·292
Manganese.........	55	12·2 In permanganate 26·2 ?	0·222 or 0·476 ?
Mercury...........	200	20·2 ?	0·101 ?
Nickel..............	58·8	10·4	0·177
Nitrogen...........	14	4·1 In high oxides 5·3	0·293 or 0·379
Oxygen	16	2·9	0·181
Palladium	106·5	22·4 ?	0·210 ?
Phosphorus	31	18·3 (other values ?)	0·590
Platinum	197·4	26·0	0·132
Potassium	39·1	8·1	0·207
Rhodium	104·4	24·2 ?	0·232 ?
Rubidium	85·4	14·0	0·164
Silicon	28	7·5 ? In silicates 6·8	0·268 ? or 0·243
Silver	108	15·7 ?	0·145 ?
Sodium	23	4·8	0·209
Strontium	87·5	13·6	0·155
Sulphur	32	16·0 (other values ?)	0·500
Thallium	204	21·6 ?	0·106 ?
Tin..................	118	19·2 ?	0·163 ?
Titanium	50	25·5 ?	0·510 ?
Vanadium	51·2	25·3 ?	0·494 ?
Zinc	65·2	10·2	0·156
Zirconium	89·6	21·0 ?	0·234 ?

The equivalents that have been deduced from only one compound, or of which the different determinations are not fairly accordant, are marked ? in the above Table.

The specific refractive energy of a body is in some respects worthy of more consideration than the refraction-equivalent, since, being only the refractive index minus 1 divided by the density, it is a physical property independent of chemical theories as to the atomic weight. Among suggestive facts are noticed the extreme energy of hydrogen; the existence of pairs of analogous elements having the same, or nearly the same, energy, —as bromine and iodine, arsenic and antimony, potassium and sodium, manganese and iron, nickel and cobalt; and that among the metals capable of forming soluble salts there is some connexion between their power to saturate the affinities of other elements, and their power to retard the rays of light.

XXV. "On the Structure of the Cerebral Hemispheres." By W. H. Broadbent, M.D., Lecturer on Physiology at St. Mary's Hospital Medical School, and Senior Assistant Physician to the Hospital, Physician to the Fever Hospital. Communicated by F. Sibson, M.D. Received June 17, 1869.

(Abstract.)

The object of the investigation has been twofold. First and chiefly, to endeavour to ascertain minutely the course of the fibres by which the convolutions of the hemisphere are connected with each other and with the crus and central ganglia.

Secondly, to endeavour to ascertain whether there is a constant similarity between the corresponding sides of different brains as compared with the opposite sides of the same brain; and should this be the case, to endeavour to trace the relation between any anatomical difference which might be discovered and such physiological difference as seems in the present state of our knowledge to be indicated by the association of loss of the faculty of language with disease of the *left* hemisphere rather than the right.

The present communication relates almost exclusively to the first branch of the investigation, and the method pursued has been to harden the brain by prolonged immersion in strong spirit, by which the fibres are rendered perfectly distinct and fairly tenacious, so that with care and patience their course and arrangement may be accurately ascertained.

Previous researches on the structure of the cerebrum have been mainly directed to the examination of the course and distribution of the fibres radiating from the crus and central ganglia, which have been assumed or supposed to occupy ultimately the axis of every convolution, the different convolutions being connected by fibres which crossed under the sulci from one to another. It is here shown that the commissural communication